Reference Datasets for Training and Evaluating RF Signal Detection and Classification Models

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There are several potential uses of artificial intelligence (AI) and machine learning (ML) in next-generation shared spectrum systems. However, while recognized datasets exist in certain domains such as speech, handwriting and object recognition, there are no equivalent robust and comprehensive datasets in the wireless communications and radio frequency (RF) signals domain. Therefore, we propose creating an RF signal database focused on the signals, schemes, systems and environments found in these applications. Our intention is to create datasets that have the following characteristics: targeted around specific applications and systems relevant to the next generation of advanced communications, composed of traceable elements and carefully curated to be representative of the target application. Datasets may consist of field measurements, data collected in a controlled laboratory setting, synthetically generated waveforms or any combination of the above.

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I. Introduction

Machine learning (ML) using deep learning (DL) algorithms has recently found considerable success in numerous research fields and applications as diverse as computer vision, speech recognition, image processing, language modeling and natural language processing, information retrieval, clustering, finance, robotics, business management, energy, transportation, and health care [1]–[5]. In line with the surge of interest in DL research, there are a number of potential uses of artificial intelligence (AI) in general, and ML in particular, in the next generation communications systems. For example, ML could be used to improve the performance of individual components of fifth generation (5G) cellular systems such as antenna configuration, beamforming training and tracking and overall multiple-input multiple-output (MIMO) system optimization. They could be used to model the environment via channel estimation and to control end-to-end performance by mapping quality of service (QoS) and quality of experience (QoE) measures to system parameters for given channel conditions. Prior to deployment, they could be used at the radio frequency (RF) planning stage to ensure sufficient coverage. In most of these communications applications, there is a need for the system to adapt to changing conditions, whether they be a wireless channel, end user traffic, or the service area of a provider [5]–[7]. Furthermore, ML and DL techniques have been used for cognitive radio systems and proposed for applications of physical layer and propagation models [8]–[10].